APPENDIX N – GEOTECHNICAL INVESTIGATION REPORT

RMA Engineers Pty Ltd

Geotechnical Investigation Report

RMA Engineers Pty Ltd

Date 13th June 2022

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Project Name GA - Toowoomba Region Sports Precinct - Charlton

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1. Introduction

Toowoomba Regional Council is proposing to construct a Regional Sports Precinct within the Charlton area. The sports precinct encompasses twelve allotments which will include:

- Lot 24 on registered plan SP214746
- Lots 112 to 117 on registered plan A345
- Lots 110 & 111 on registered plan SP272107
- Lot 118 & 119 on registered plan SP203198
- Lot 276 on registered plan SP268921

The field investigation was completed two stages, Stage 1 on the 24th of September 2021 and Stage 2 on the 14th & 15th of March 2022.

The location of the site is shown in Figures 1 & 2 presented in Appendix A. The master plan of the site is shown presented in Appendix B.

The sports precinct development will include:

- Premier Hub & Facilities
- Clubhouse Facilities at several grounds
- Several Playing Fields / Ovals
- Diamond Fields Precinct
- Shooting and Archery Precinct
- District Park and Ornamental Lake
- Boundary Planting Screen Buffers
- Internal Roads
- Upgrade of Gowrie Junction Road between new Site Access and the Toowoomba Connection Road with 2.5m on-road cycle lanes
- Carparking facilities

2. Scope of Services

RMA Soils component of the work is generally to undertake a broadscale site assessment to inform on the preliminary civil design and feasibility of constructing a multi-use, multi-field, multi-facility sports precinct with associated facilities and internal roads.

The objective of the geotechnical investigation was to provide information on the:

- Subsurface profile including depth to bedrock
- Bearing capacity of subsurface materials
- Temporary and permanent batter slopes
- Preliminary bulk earthworks design
- Slope stability
- Site Trafficability
- Material use
- Earthworks

To collect the appropriate data and site information, the methodology and scope of works for the investigation and laboratory testing program included:

- drilling boreholes up to 10m depth or prior refusal
- assessing the relevant site characteristics and details
- collecting samples to undertake laboratory testing to determine:
    - Plasticity
    - Dispersive Potential

3. Geotechnical Investigation

3.1 Site Description

The site is located approximately 10km to the north west of the Toowoomba CBD.

The site is bound on the eastern site by rural properties, on the northern and western sides by the Warrego Highway and on the southern side by the Toowoomba Connection Road.

Access to the site is via a dirt road from Gowrie Junction Road to the east.

At present, several small structures, which are part of the SSAA club, are located within the south part of Lot 24.

The area is sparsely to densely grassed with short to tall grasses and sparsely timbered with small to large trees.

Basalt cobbles and boulders were observed on the surface and encountered within boreholes.

Watercourses were observed within the northern and south western sections of Lot 24. These drain surface water to the north west.

The natural contours across the site fall generally to the north west. The slope angles are variable, ranging from gentle to moderate. The moderate slopes are to the south east.

The site characteristics are shown in Figures 3 to 31 presented in Appendix A.

3.2 Field Investigation

The field investigation was undertaken in two stages, Stage 1 on the 24th of September 2021 and Stage 2 on the 14th & 15th of March 2022. The drilling was carried out using a drill rig mounted on a Fuso Truck.

Open flight auguring was utilised from the ground surface to the termination depth of the boreholes. The field investigation consisted of:

- Drilling & logging 22 boreholes
- Boreholes drilled to between 1.3m & 10.0m depth
- Disturbed samples collected for:
    - Atterberg Limits
    - Emerson Class Number

The soil classification descriptions, field and laboratory testing were carried out in general accordance with Australian Standards:

- AS1289-2000: Methods of Testing Soils for Engineering Purposes
- AS1726-2017: Geotechnical Site Investigations

The borehole locations are presented in Appendix C. The borelogs are presented in Appendix D.

3.3 Laboratory Testing

3.3.1 General

Laboratory testing was carried out on selected samples collected from the field investigation program. The testing was directed towards assessing the plasticity characteristics of the subsurface materials along with the strength of potential subgrade materials.

The laboratory testing was carried out in general accordance with the relevant Australian Standards from AS1289-2000 Methods of Testing Soils for Engineering Purposes. Laboratory testing included:

- Atterberg Limits testing – to assess plasticity
- Emerson Class Number testing – to assess dispersive potential

The results of the laboratory testing shown in the Sections below.

3.3.2 Atterberg Limits Testing Results

Disturbed samples were collected during the field investigation and were used to undertake Atterberg Limits testing in accordance with AS1289.3.4.1 (LS) and 1289.3.9.1 (LL).

The Atterberg Limits test results are outlined in Table 1 below. The test reports are presented in Appendix E.

Table 1: Laboratory Test Results – Atterberg Limits

Test Locations	Depth (m)	Material Type	Liquid Limit (%)	Linear Shrinkage (%)
BH1	1.90 – 2.10	XW BASALT: *Clayey Gravelly SAND*	36.3	8.0
	3.40 – 3.60	XW BASALT: *Clayey SAND*	35.7	8.6
BH2	1.90 – 2.10	XW BASALT: *Sandy Gravelly CLAY*	102.6	24.6
BH5	0.90 – 1.10	HW BASALT	33.5	8.0
BH8	1.40 – 1.60	XW BASALT: *Clayey Gravelly SAND*	35.7	9.1
BH9	1.90 – 2.10	Sandy Gravelly CLAY	63.3	18.6
BH10	0.60 – 1.00	XW BASALT: *Silty Sandy CLAY*	48.4	8.2
	2.00 – 3.00	XW BASALT: *Silty Sandy CLAY*	47.8	9.1
BH11	0.70 – 1.10	XW BASALT: *Silty Sandy CLAY*	43.1	11.4

Test Locations	Depth (m)	Material Type	Liquid Limit (%)	Linear Shrinkage (%)
BH12	3.50 – 4.00	XW BASALT: *Sandy GRAVEL*	43.6	9.9
BH13	1.50 – 2.00	XW BASALT: *Silty Sandy CLAY*	60.0	14.2
	4.50 – 5.00	XW BASALT: *Silty SAND*	47.3	12.2
BH14	0.40 – 0.80	XW BASALT: *Silty Sandy CLAY*	38.3	8.2
BH15	2.50 – 3.00	XW BASALT: *Silty Sandy GRAVEL*	37.5	9.9
BH16	0.40 – 1.00	XW BASALT: *Silty Sandy CLAY*	32.6	4.9
BH17	0.00 – 0.40	Silty Sandy CLAY	71.7	18.1
BH20	0.30 – 0.60	Silty CLAY	88.7	23.0
	2.00 – 3.00	XW BASALT: *Silty Sandy CLAY*	64.8	18.2
	5.00 – 6.00	XW BASALT: *Silty Gravelly SAND*	49.0	12.7
BH21	9.00 – 10.00	XW BASALT: *Clayey Gravelly SAND*	71.6	17.0

3.3.3 Emerson Class Number Results

Part of the sample used to complete Atterberg Limits testing was used to undertake Emerson Class Number testing. This testing was completed in accordance with AS1289.3.8.1.

The Emerson Class Number test results are outlined in Table 2 below with the reports presented in Appendix E.

Table 2: Laboratory Test Results – Emerson Class Number

Test Locations	Depth (m)	Material Type	Emerson Class Number	Dispersive Potential
BH10	0.60 – 1.00	XW BASALT: *Silty Sandy CLAY*	4 *	Moderate to Low
	2.00 – 3.00	XW BASALT: *Silty Sandy CLAY*	4 *	Moderate to Low
BH11	0.70 – 1.10	XW BASALT: *Silty Sandy CLAY*	4 *	Moderate to Low
BH12	3.50 – 4.00	XW BASALT: *Sandy GRAVEL*	4 *	Moderate to Low

Test Locations	Depth (m)	Material Type	Emerson Class Number	Dispersive Potential
BH13	1.50 – 2.00	XW BASALT: *Silty Sandy CLAY*	4 *	Moderate to Low
	4.50 – 5.00	XW BASALT: *Silty SAND*	4 *	Moderate to Low
BH14	0.40 – 0.80	XW BASALT: *Silty Sandy CLAY*	4 *	Moderate to Low
BH15	2.50 – 3.00	XW BASALT: *Silty Sandy GRAVEL*	6	Low to Very Low
BH16	0.40 – 1.00	XW BASALT: *Silty Sandy CLAY*	3	Moderate
BH17	0.00 – 0.40	Silty Sandy CLAY	7	Very Low
BH20	0.30 – 0.60	Silty CLAY	7	Very Low
	2.00 – 3.00	XW BASALT: *Silty Sandy CLAY*	3	Moderate
	5.00 – 6.00	XW BASALT: *Silty Gravelly SAND*	2	High
BH21	9.00 – 10.00	XW BASALT: *Clayey Gravelly SAND*	4 *	Moderate to Low
** Carbonate in the soil*				

3.3.4 Groundwater

At the time of the investigation groundwater was not encountered within the termination depth of the boreholes.

Differing material types were encountered during the drilling and seepage could be expected through the more permeable soils and material interfaces during and after periods of rainfall.

4. Geotechnical Assessment

4.1 Regional Geology

The 1:500,000 scale Moreton Geological Map published by the Geological Survey of Queensland in 1978 indicates that the surface and near-surface geology of the site comprises:

- Tertiary age Main Range Volcanics: basalt, agglomerate, shale & dolomite

The subject site is located within the Tertiary age Main Range Volcanics and associated residual soils. The regional geology of the area is shown in Figure 32 presented in Appendix A.

4.2 Subsurface Profile

The site investigation consisted of drilling and logging twenty-two boreholes. The boreholes were drilled around the site.

NATURAL SOIL

Silty CLAY – high plasticity (CH), dry to moist, stiff. Trace of medium grained gravel.

Silty Sandy CLAY – high plasticity (CH), fine to medium grained sand, dry to moist, stiff. Trace of medium grained gravel.

Gravelly CLAY – high plasticity (CH), fine to coarse grained sand, fine to coarse grained gravel, dry to moist, stiff. Intermixed with basalt cobbles & boulders. Trace of fine to medium grained sand.

Sandy Gravelly CLAY – high plasticity (CH), fine to coarse grained sand, fine to medium grained gravel, dry to moist, stiff. Intermixed with basalt cobbles & boulders.

BEDROCK

Moderately Weathered (MW) / Highly Weathered (HW) / Extremely Weathered (XW)

XW Basalt recovered as:

Silty SAND – low plasticity (SM), fine to medium grained sand, dry to moist, medium dense to dense. With fine to medium grained gravel.

Clayey Silty SAND – low to medium plasticity (SM), fine grained sand, dry, medium dense to dense. With fine to medium grained gravel.

Clayey Gravelly SAND – low to medium plasticity (SW), fine to medium grained sand, fine to medium grained gravel, dry to moist, medium dense.

Silty Gravelly SAND – low plasticity (SW), fine to medium grained sand, fine to medium grained gravel, dry to moist, medium dense to dense.

Sandy GRAVEL – medium plasticity (GW), fine to medium grained sand, fine to medium grained gravel, dry, medium dense to dense.

Silty Sandy GRAVEL – medium plasticity (GW), medium to coarse grained sand, medium to coarse grained gravel, dry, medium dense to dense.

Sandy Gravelly CLAY – medium to high plasticity (CI / CH), fine to coarse grained sand, fine grained gravel, dry, stiff.

Silty Sandy Gravelly CLAY – medium plasticity (CI), medium to coarse grained sand, fine grained gravel, dry to moist, stiff.

Silty Sandy CLAY – medium to high plasticity (CI / CH), medium to coarse grained sand, fine grained gravel, dry to moist, stiff. With fine grained gravel.

Auger refusal was generally encountered on Highly to Moderately Weathered Basalt. BH6 refused on cobbles & boulders.

The borehole locations are presented in Figure 21 and the borelogs are presented in Appendix C. A summary of the subsurface profile is shown in Table 3.

Table 3: Summary of the Subsurface Profile

Borehole		Soils		Bedrock	
Number	**Depth (m)**	**Type**	**Thickness (m)**	**Depth (m)**	**Type**
BH1	5.0	Silty CLAY	0.50	0.50 3.20	XW BASALT: *Clayey Gravelly SAND* XW BASALT: *Clayey SAND*
BH2	5.0	Silty Sandy CLAY	1.50	1.50	XW BASALT: *Sandy Gravelly CLAY*
BH3	4.5 *Refusal*	Silty CLAY	0.90	0.90 1.80	XW BASALT: *Sandy Gravelly CLAY* XW BASALT: *Clayey Gravelly SAND*
BH4	2.3 *Refusal*	Silty CLAY	0.90	0.90 2.20	XW BASALT: *Sandy Gravelly CLAY* XW BASALT: *Clayey Gravelly SAND*
BH5	1.8 *Refusal*	Silty CLAY	0.20	0.20 1.80	XW BASALT: *Sandy Gravelly CLAY* HW BASALT
BH6	0.6 *Refusal*	Not Encountered	-	0.00	MW BASALT: cobbles & boulders
BH7	2.2 *Refusal*	Silty CLAY	0.40	0.40 1.50	XW BASALT: *Clayey Gravelly SAND* HW BASALT
BH8	2.5 *Refusal*	Silty CLAY	0.40	0.40	XW BASALT: *Clayey Gravelly SAND*

Borehole		Soils		Bedrock	
Number	Depth (m)	Type	Thickness (m)	Depth (m)	Type
BH9	5.0	Gravelly CLAY Sandy Gravelly CLAY	0.60 3.50	4.10	XW BASALT: *Sandy Gravelly CLAY* HW BASALT
BH10	5.5	Silty Sandy CLAY	0.80	0.80	XW BASALT: *Silty Sandy CLAY*
BH11	4.0	Silty CLAY	0.50	0.50	XW BASALT: *Silty Sandy CLAY*
BH12	8.0 *Refusal*	Silty CLAY	0.70	0.70	XW BASALT: *Silty Sandy CLAY* XW BASALT: *Sandy GRAVEL*
BH13	6.8 *Refusal*	Silty CLAY	0.50	0.50 3.70	XW BASALT: *Silty Sandy CLAY* XW BASALT: *Silty SAND*
BH14	4.0 *Refusal*	Silty CLAY	0.40	0.40 1.40	XW BASALT: *Clayey Gravelly SAND* XW BASALT: *Silty Gravelly SAND*
BH15	3.8 *Refusal*	Silty Sandy CLAY	0.40	0.40	XW BASALT: *Silty Sandy CLAY* XW BASALT: *Silty Sandy GRAVEL*
BH16	4.2 *Refusal*	Silty Sandy CLAY	0.40	0.40 0.90	XW BASALT: *Silty Sandy CLAY* XW BASALT: *Silty Gravelly SAND*
BH17	1.8 *Refusal*	Silty Sandy CLAY	0.50	0.50 1.60	XW BASALT: *Clayey Gravelly SAND* XW BASALT: *Silty Gravelly SAND*
BH18	4.4 *Refusal*	Silty CLAY	0.70	0.70	XW BASALT: *Clayey Silty SAND*
BH19	8.1 *Refusal*	Silty CLAY	1.80	1.80 2.70 3.80	XW BASALT: *Silty Sandy CLAY* XW BASALT: *Silty SAND* XW BASALT: *Silty Gravelly SAND*
BH20	10.0	Silty CLAY	0.80	0.80 1.90 7.80	XW BASALT: *Clayey Gravelly SAND* XW BASALT: *Silty Gravelly SAND* XW BASALT: *Clayey Gravelly SAND*
BH21	5.0	Silty CLAY	0.60	0.60 1.10	XW BASALT: *Silty SAND* XW BASALT: *Silty Gravelly SAND*

Borehole		Soils		Bedrock	
Number	Depth (m)	Type	Thickness (m)	Depth (m)	Type
BH22	5.0	Silty CLAY	1.00	1.00 2.80	XW BASALT: *Sandy CLAY* XW BASALT: *Clayey SAND*

NOTE: Descriptions of the bedrock are based on as recovered samples. The material may appear differently when exposed using earthmoving machinery.

4.3 Foundations

4.3.1 Site Classification

The classification of soil reactivity for a particular site to allow for the design of foundations, strictly only applies to residential buildings up to two-storeys and to other buildings of similar size, loading and flexibility as defined in accordance with AS 2870–2011.

Such a classification is a useful tool to assess the potential movement that a site may experience with “normal” seasonal variations in moisture (AS2870).

Based on the borelogs and laboratory testing, the potential ground surface movements, Ys, that the site overall may experience due to variations in subsurface moisture conditions during normal climatic changes, are outlined in Table 4. (AS2870 – Section 2).

Table 4 outlines the Ys values and the potential of the profile to swell/shrink under normal climatic changes, in terms of reactivity. This swelling &/or shrinking of the soils, particularly clay soils, is attributed to the absorption &/or loss of moisture.

The site classifications are outlined in Table 4.

Table 4: Site Classification Summary

Borehole Number	Estimated Surface Movement (Ys) (mm)	Assumed Earthworks (m)	Site Classification
BH1	20 - 30	Cut / 4.0	M
BH2	20 - 30	Cut / 4.0	M
BH3	20 - 30	Cut / 3.0	M
BH4	75 - 85	None	E
BH5	20 - 30	Cut / 2.0	M
BH6	40 - 50	None	H1

Borehole Number	Estimated Surface Movement (Ys) (mm)	Assumed Earthworks (m)	Site Classification
BH7	40 - 50	None	H1
BH8	20 - 30	Cut / 2.0	M
BH9	80 - 90	Cut / 0.5	E
BH10	75 - 85	None	E
BH11	40 - 50	Cut / 0.5	H1
BH12	40 - 50	Cut / 0.5	H1
BH13	40 - 50	Cut / 2.0	H1
BH14	30 - 40	Cut / 2.0	M
BH15	65 - 75	None	H2
BH16	20 - 30	Cut / 1.8	M
BH17	50 - 60	None	H1
BH18	60 - 70	Cut / 1.8	H2
BH19	10 - 20	Cut / 5.0	S
BH20	10 - 20	Cut / 5.0	S

The site classification is based on the following:

- Profile within each borehole
- Zone of moisture variation of 2.3m
- Cracked zone of 1.15mm deep
- pF = 1.2
- Profile as it was at the time of the investigation without undertaking further earthworks for building platform construction

Good practice in design, construction and management of the site will be required to accommodate the potential site movements. This will include management of surface and subsurface drainage throughout the site along with limits on landscaping and adequate moisture preparation.

4.3.2 Subsurface Strength Parameters

High level foundation systems should be designed and constructed to accommodate the potential ground movement resulting from the volume instability of the reactive clay soils.

All footings should extend through uncontrolled fill (if any) and found a minimum of 200mm into controlled fill or competent natural soils. Table 5 below outlines allowable bearing capacities for high level footings on the site.

Table 5: Allowable Bearing Capacities for High Level Footings (FOS = 3)

Material		Allowable Bearing Capacity (Qa) (kPa)	
		Strip Footing *(min 0.3m wide)*	**Pad Footing** *(min 2.0m wide)*
Clay	Stiff	100	150
Rock	Extremely Low (XW) Low (HW)	200 300	250 400
Note: FOS = 3; HW – material encountered at Auger Refusal			

The borelogs show firm or better materials within the subsurface. Bearing capacity of the soils should be confirmed prior to foundation construction.

4.3.3 Negative and Positive Skin Friction

Positive and Negative skin friction may be encountered at this site. These may be due to settlement of the piles, installation of the piles into compressible strata, shrinking and cracking of the upper soil layers or swelling soils. Foundations should be designed to reduce the effect of these factors.

5. Engineering Assessment

5.1 Pavement Subgrade

Subgrade conditions are expected to typically consist of new engineered filling, natural clays or weathered basalt depending on the height of the road above or below the existing ground surface.

The design of flexible pavements will depend on the quality of the potential subgrade material.

Where the road is generally at existing ground surface height, clay materials will most likely be encountered. It is common for these materials to return CBR values around 2% which correlates to very low strength for pavement design.

The basalt encountered across the site is shown to be variably weathered. When excavated these may have similar properties to sandy clays or clayey sands.

Where the subgrade material is weathered basalt and generally sandy clay in nature, it is common for these materials to return CBR values of between 5% & 7%. This then correlates to low strength for pavement design.

Where the subgrade material is weathered basalt and more sand or gravel in nature, it is common for these materials to return CBR values of 10% or greater. This then correlates to medium strength or better for pavement design.

The subgrade material should be confirmed onsite once the final platform level is known. The CBR of this material should then be confirmed by laboratory testing prior to finalising the pavement design.

5.2 Site Earthworks

The proposed sports park precinct is around 135ha in area and as such will require large amounts of cut and fil to provide suitable areas for playing fields and associated buildings.

The preliminary bulk earthworks plan is presented in Appendix F and shows cut and fill depths to greater than 5m.

It is recommended that the filled areas, particularly below the proposed structures, is constructed in accordance with the procedures outlined in AS3798 – 2007.

AS3798 – 2007 recommends that before any fill is placed, the subgrade area below the fill area should be scraped free of all significant organic material and debris. All soils containing organic and deleterious matter should be stripped to the base of the root systems. This material is not considered suitable for reuse as controlled fill. The stripped soils could be stockpiled for landscaping purposes only.

AS3798 – 2007 recommends that the grub holes produced during tree removal should be backfilled and compacted to prevent ‘soft’ spots occurring underneath future structures which may lead to differential settlement. Backfilling must be done in accordance with the procedures outline in AS 3798 – 2007. This will also apply to backfilling the following the removal of large rocks.

If cut and fill is required, then the fill should be clean spoil recovered from the site cut and laid down in 150mm (maximum) layers. Each layer should be moistened and compacted using suitable compaction equipment to a minimum 95% standard compaction. Each 300mm lift should be tested in accordance with AS1289.5.1.1, 5.3.1 or 5.8.1 and 5.4.1.

The subgrade below any pavement layers or filled platform should be tyned to a depth of 150mm and recompacted a minimum of 98% standard compaction. The pavement layers for any carparks or driveways should be compacted to 100% standard compaction. The layers should be

compacted in 150mm (maximum) layers. Each layer should be moistened and compacted using suitable compaction equipment. Each 300mm lift should be tested in accordance with AS1289.5.1.1, 5.3.1 or 5.8.1 and 5.4.1.

Should compaction testing be required, RMA Soils can be engaged to carry out compaction density testing during the bulk earthworks phase of the construction.

5.3 Excavatability

The target depth for termination of the boreholes was 5m. Boreholes BH1, BH2 & BH9 were terminated at the target depths of 5m. Boreholes BH3 to BH8 encountered auger refusal between 0.6m & 4.5m depth. Drilling was undertaken using a 100mm diameter hydraulic auger.

Excavations within the clays and extremely weathered basalt could be undertaken using conventional small to medium sized earthmoving equipment, such as drotts, backhoes or 5 to 15t (or larger) excavators.

Based on the borelogs, highly to moderately weathered of low to medium strength or better basalt may possibly be encountered in some excavations. Excavations in these materials may require larger equipment (ie. up to 30t excavators) fitted with a ripping tyne and/or rock breaker tools, particularly for confined excavations.

It should be noted that the excavatability estimates are based on materials encountered at the test locations only and that conditions may differ for excavatability beyond these test locations and the termination depths drilled or excavated as part of this investigation.

5.4 Material Usage / Import Type

The insitu clays and extremely weathered basalt, where free of organic and deleterious material, may be used for structural fills.

It is however, recommended that the sandy, gravelly & silty clays are not used as fill material below future structure as this will potentially increase the site classification.

The weathered basalt encountered, will have variable clay content. Where it contains >30% clay fines, this material may be used as structural fill.

Where the weathered basalt contains <20% clay fines it should not be used. However, the weathered basalt may be mixed with clay fines to form a material that can be used as structural fill.

It should be noted that the onsite soils could be expected to present difficulties in handling, placement, and compaction if the appropriate moisture content is not achieved, particularly if the soils are overly moist. The detailed design should consider the effect of earthworks on site classification.

If imported, reactive clay soils are to be used, close control of moisture content during placement and compaction is required so as to minimise the potential for swelling and shrinkage movement. A moisture content within the range of OMC (standard Optimum Moisture Content) -3% to OMC +1% is recommended. Foundation design must reflect the use of the potentially reactive clays if they are used as structural fill.

Generally, any imported general fill material should be free of deleterious material, of good quality with a Liquid Limit of less than 60% & Linear Shrinkage of less than 15%, a maximum particle size of 26mm with at least 90% passing the 19mm sieve. Quality testing to confirm imported fill quality should be carried out prior to delivery to site.

The sports precinct development includes the construction of playing fields and parklands which will require the establishment of grasses and other plants.

Many of these areas are positioned within the deep cut zones shown in the bulk earthworks plan presented in Appendix E and it is likely that highly weathered basalt will be exposed in these areas.

Also, the excavated weathered basalt from the cut zones will likely be used as fill material, and this may be exposed at the surface of the some filled areas.

The highly weathered basalt, particularly when exposed in cut areas, is generally not conducive to plant growth. As such, the establishment of grasses and plants in these areas will require importing high quality underturf soils that will provide the necessary elements for plant growth and development.

An experienced landscaper should be consulted to determine the most appropriate material types and thicknesses that should be used to give the best outcome.

5.5 Batter Slopes

If cut batters are required, when cut, these batters may consist of either clay or weathered basalt or a combination of both. The recommended batter angles will be different for both material types.

Provided there are no structures, service trenches, traffic areas or other forms of surcharge near the slope crests, batter slopes cut to no deeper than 3m vertical height in natural soils may be designed for the batter angles presented in Table 6 below.

Short term slopes could also be benched at the overall angles given in Table 6.

Table 6: Batter Slope Angles (up to 3m in height)

Material		Short Term (°)	Long Term (°)
Clay	Stiff	40 (1V:1.2H)	26 (1V:2H)
Basalt	XW (Stiff / Medium Dense) HW (Very Stiff / Dense)	26 (1V:2H) 40 (1V:1.2H)	18 (1V:3H) 26 (1V:2H)

The expected cut and fill batters shown on the bulk earthworks plan presented in Appendix E are extensive and will be comprised of clay and weathered basalt. These materials will behave differently when exposed to weather events. Regardless of the material types exposed within the batters, surface protection will be required to reduce the potential risk of erosion. Ground cover such as grass, topsoil or mulch could be used. Diverting surface water away from the batters where possible will also reduce erosion potential.

In the long term, batters may need to be flattened to 1V:3H or shallower to allow for vehicle access and may require drainage at the top and bottom of the batter to prevent water build in these areas.

The short-term batters should be shaped to prevent water runoff over the face during the proposed exposure period.

Temporary excavations up to 1.5m in depth in most of the soils can remain near vertical for short periods of time, provided that they remain dry at the time of construction and provided there are no loads, services, structures or traffic located within a distance from the crest of the batter equal

to the slope height. This should be assessed by a geotechnical engineer or engineering geologist.

The above temporary batter slopes are suggested with respect to slope stability only, and do not allow for lateral stress relaxation which may result in movement of nearby in-ground services or shallow footings. The above temporary batter slopes are suggested with respect to slope stability only, and do not allow for lateral stress relaxation which may result in movement of nearby in-ground services. If such services are settlement-sensitive and are located near the crest of the cut face, then the excavation may have to be positively supported.

If surcharge loads (i.e. footings) are applied near the crest of the slope then further geotechnical review and consideration should be given to flattening batters or stabilisation using soil nails. Where batters cannot be accommodated, shoring or support will be required.

5.6 Site Trafficability

At the time of the field investigation trafficking problems were not encountered. Trafficking problems for earthworks and construction machinery may arise due to the clayey nature of the surface and near surface materials. These problems may be caused by:

- Rainfall events softening the surface and near surface soils.
- Disturbance of the surface and near surface soils with the removal of vegetation, rock & ground cover and construction of underground elements.
- Disturbance of the surface and near surface soils with the construction of underground elements.

To minimise these problems, the site trafficability may be improved by:

- Controlling water seepage/drainage by diverting runoff away from the construction area to prevent ponding.
- Adequate compaction of the fill material used to backfill any constructed underground elements.
- Proof rolling the exposed area following stripping, clearing and grubbing to identify any weak areas and then compacting the subgrade, as outline in Section 8.1, to strengthen these areas
- “Sealing” the construction area by rolling with a smooth drum roller at the completion of each day or prior to any rain event.
- Providing an all-weather working layer consisting of either:
  - crushed concrete type material, or
  - large size gravel, or
  - imported sub-base material.

Areas which demonstrate excessive movement and/or do not improve sufficiently after compaction should be removed and replaced as outlined in Section 5.5.

All subgrades below pavements, structures and heavy machinery should be inspected by competent persons to identify any weak areas in the founding materials. Weak areas may cause

failures in pavements, structures and lead to issues with subsidence below heavy machinery during construction.

5.7 Seismic Sub-Soil Class and Site Factor

The site sub-soil class for earthquake actions in this report is based on assessment of geological information collected during the site investigations and methods provided in Australian Standard AS1170.4-2007 – Structural design actions - Part 4: Earthquake actions in Australia.

In accordance with Section 4.2 of AS1170.4 the site sub-soil class of the proposed site is “Class Ce – Shallow Soil.” In accordance to Table 4.1 and Figure 3.2(F) a Hazard Design Factor of 0.06 should be adopted for the proposed site.

5.8 Working Platforms for Tracked Plant

Detailed design of a Working Platform for Tracked Plant should be carried out if large machinery is to be used during construction of the buildings. This is particularly important when considering the use of heavy cranes and piling rigs. The piling/crane contractor should be consulted regarding their requirements and a geotechnical study undertaken if required.

6. Construction Inspection

It is recommended that placement of all structural fill, footing excavations, and cut batter slopes in soil and rock together with building and pavement subgrades should be inspected by a suitably qualified Geotechnical Engineer/Engineering Geologist. Should subsurface conditions other than those described in this report be encountered, RMA Soils Pty Ltd should be consulted immediately and appropriate modifications developed and implemented if necessary.

7. Conclusions

A broadscale geotechnical investigation was carried out within twelve allotments that will comprise the sports precinct at Charlton.

The fieldwork for the first phase of the investigation was confined to Lot 24 on registered plan SP214746, Lot 112 on registered plan A345 and Lots 110 & 111 on registered plan RP272107, Warrego Highway Charlton. The second phase of the investigation included the remaining allotments. The field investigation was undertaken in two stages, Stage 1 on the 24th of September 2021 and Stage 2 on the 14th & 15th of March 2022.

Toowoomba Regional Council proposing to construct a multi-use, multi-field, multi-facility sports precinct with associated facilities and internal roads. The development will include:

- Premier Hub & Facilities
- Clubhouse Facilities at several grounds
- Several Playing Fields / Ovals
- Diamond Fields Precinct
- Shooting and Archery Precinct
- District Park and Ornamental Lake
- Boundary Planting Screen Buffers
- Internal Roads
- Upgrade of Gowrie Junction Road between new Site Access and the Toowoomba Connection Road with 2.5m on-road cycle lanes
- Carparking facilities

Twenty-two boreholes were drilled for the investigation. Boreholes BH3 to BH8 and BH12 to BH19 encountered auger refusal between 0.6m & 8.1m depth. Auger refusal was on HW Basalt and basal cobbles & boulders. All other boreholes were terminated at target depths of 4.0m, 5.0m, 5.5m and 10.0m depth.

The investigations found natural soils consisting of stiff clays and bedrock consisting of extremely to highly weathered basalt. The weathered basalt was recovered as clayey, sandy & gravelly material.

Laboratory testing was undertaken on selected materials within the natural soils and bedrock.

Atterberg limits testing indicate that the natural clay materials and clayey weathered basalt have high to very high plasticity. The sandy weathered basalt has low to medium plasticity.

Emerson class number dispersive testing was completed on the clays and weathered basalt. The results indicate that the majority of materials have low dispersive potential with three samples returning moderate to high dispersive potential.

8. Limitations

This investigation is intended as a geotechnical investigation to assess the surface and subsurface materials. The assessment is to be used to assist with preliminary civil design and feasibility considerations for the proposed sports precinct. This is insufficient for detailed design of structures or roads and further specific investigations would be required for those purposes.

We have prepared this report for the use by RMA Engineers or your preferred contractor for design purposed in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has not been prepared for use by parties other than RMA Engineers or their approved consultants and/or contractors. It may not contain sufficient information for purposes of other parties or for other uses.

RMA Soils Pty Ltd offer a documentation review services to verify that the intent of geotechnical recommendations is properly reflected in the design. It is recommended that clients avail themselves of this service. Our standard fees would apply in those cases.

9. Appendices

9.1 APPENDIX A

9.1.1 Figures 1 - 32

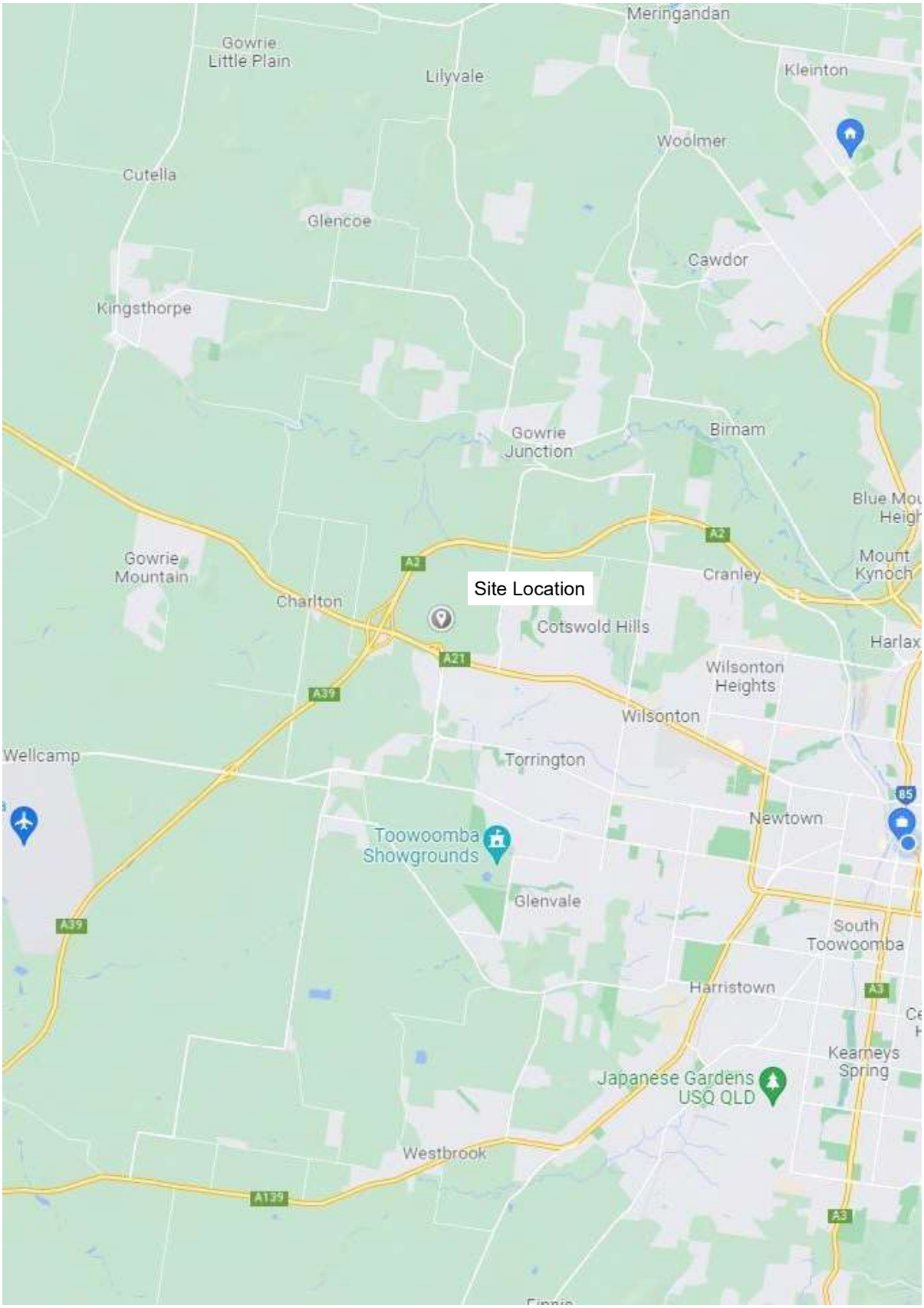


Figure 1: Site Location

Figure 2: Aerial Map of the Site Location

Figure 3: Photograph taken to the north of the BH1 looking south west

Figure 4: Photograph taken to the north of the BH1 looking west

Figure 5: Photograph taken to the north of the BH2 looking south west

Figure 6: Photograph taken to the north of the BH2 looking south west

Figure 7: Photograph taken to the north of the BH3 looking south

Figure 8: Photograph taken to the north of the BH3 looking south west

Figure 9: Photograph taken near BH4 looking west

Figure 10: Photograph taken near BH5 looking north east

Figure 11: Photograph taken near BH5 looking north west

Figure 12: Photograph taken near BH5 looking south east

Figure 13: Photograph taken near BH6 looking north

Figure 14: Photograph taken near BH6 looking south

Figure 15: Photograph taken near BH8 looking north west

Figure 16: Photograph taken near BH8 looking south west

Figure 17: Photograph taken near BH9 looking north west

Figure 18: Photograph taken near BH9 looking south west

Figure 19: Photograph taken near BH9 looking south east

Figure 20: Photograph taken near BH12 looking south east

Figure 21: Photograph taken near BH12 looking south

Figure 22: Photograph taken near BH12 looking south west

Figure 23: Photograph taken near BH12 looking west

Figure 24: Photograph taken near BH12 looking north west

Figure 25: Photograph taken near BH12 looking north

Figure 26: Photograph taken near BH15 looking east

Figure 27: Photograph taken near BH15 looking south east

Figure 28: Photograph taken near BH15 looking south

Figure 29: Photograph taken near BH15 looking west

Figure 30: Photograph taken near BH15 looking north west

Figure 31: Aerial image showing the watercourses through the site

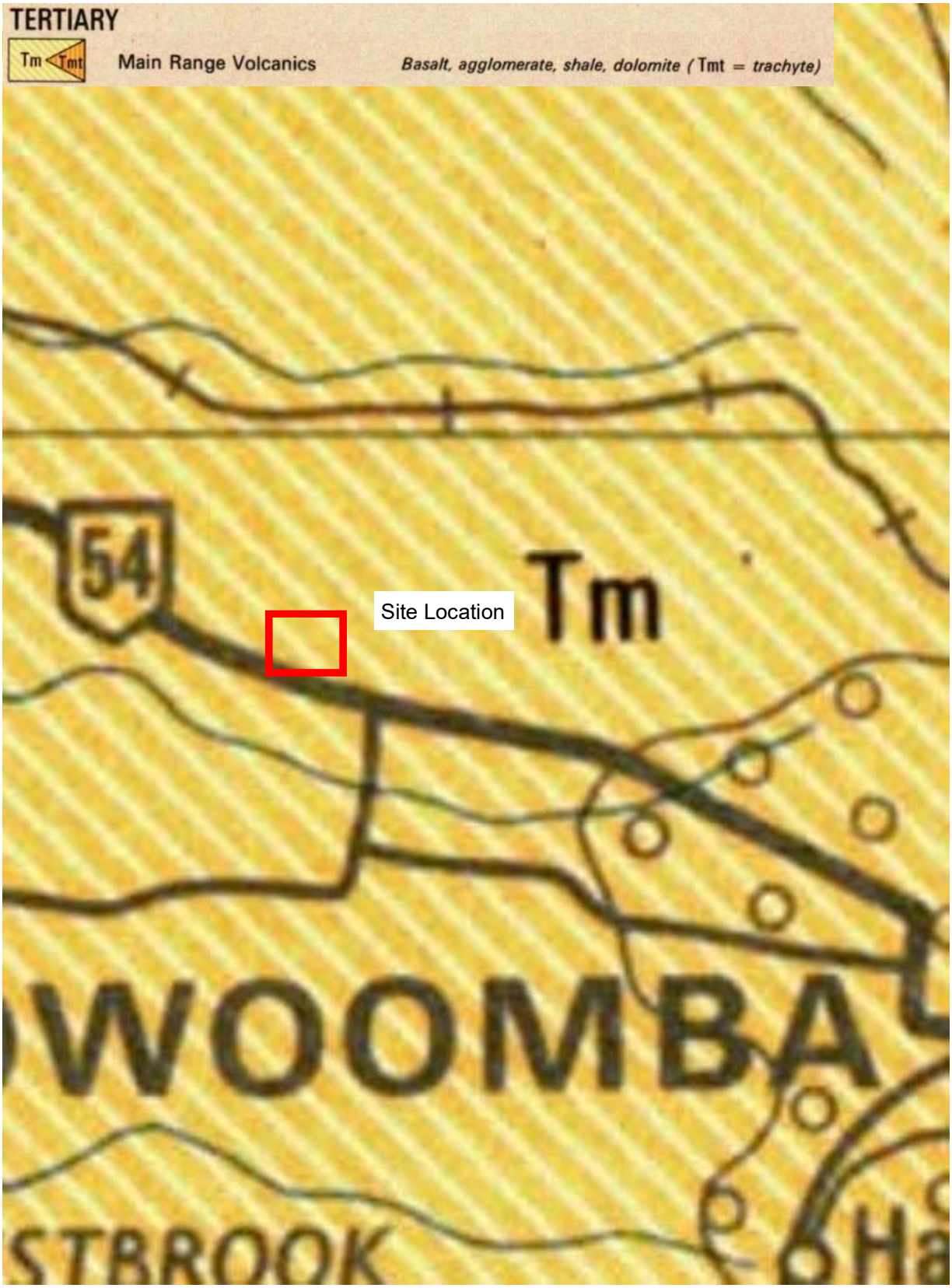


Figure 32: Regional Geology

9.2 APPENDIX B

9.2.1 Master Plan

OVERALL PLAN

1. **Main Access from Gowrie Junction Road**
2. **Toowoomba Connection Rd Highway Entry - Left In / Left Out**
3. **Tree Lined Avenue Entry Road**
4. **Premier Hub Setdown Area and Overflow Parking**
5. **Premier Hub**
6. **Premier Oval**
7. **Premier Rectangular Field**
8. **Rectangular Field Precinct 1**
9. **Formalised Car Parking**
10. **Open Parkland and Maintenance Compound**
11. **Oval Field 1**
12. **Oval Field 2**
13. **Diamond Fields Precinct**
14. **Rectangular Field Precinct 2**
15. **Rectangular Field Precinct 3**
16. **Shooting and Archery Precinct**
17. **Oval Field 3**
18. **District Park**
19. **Boundary Planting Screen Buffers**
20. **Stormwater Treatment Channels and Basins**
21. **Upgrade of Gowrie Junction Road between new Site Access and the Toowoomba Connection Road. Upgrade to include 2.5m on-road cycle lanes in each direction.**

SCALE
1:4000 @ A1
1:8000 @ A3

0m 400m 800m

LEGEND
Site Boundary

TOOWOOMBA REGION SPORTS PRECINCT

2020 MASTER PLAN

PO BOX 1640, Buddina, QLD 4575 T: 07 5493 4677 E: admin@greenedgedesign.com.au www.greenedgedesign.com.au

N

SCALE: AS SHOWN @A1
DRAWING: DC-03 [O]
PROJECT: 19009
DATE: 26-05-2022

CLIENT: TOOWOOMBA REGION

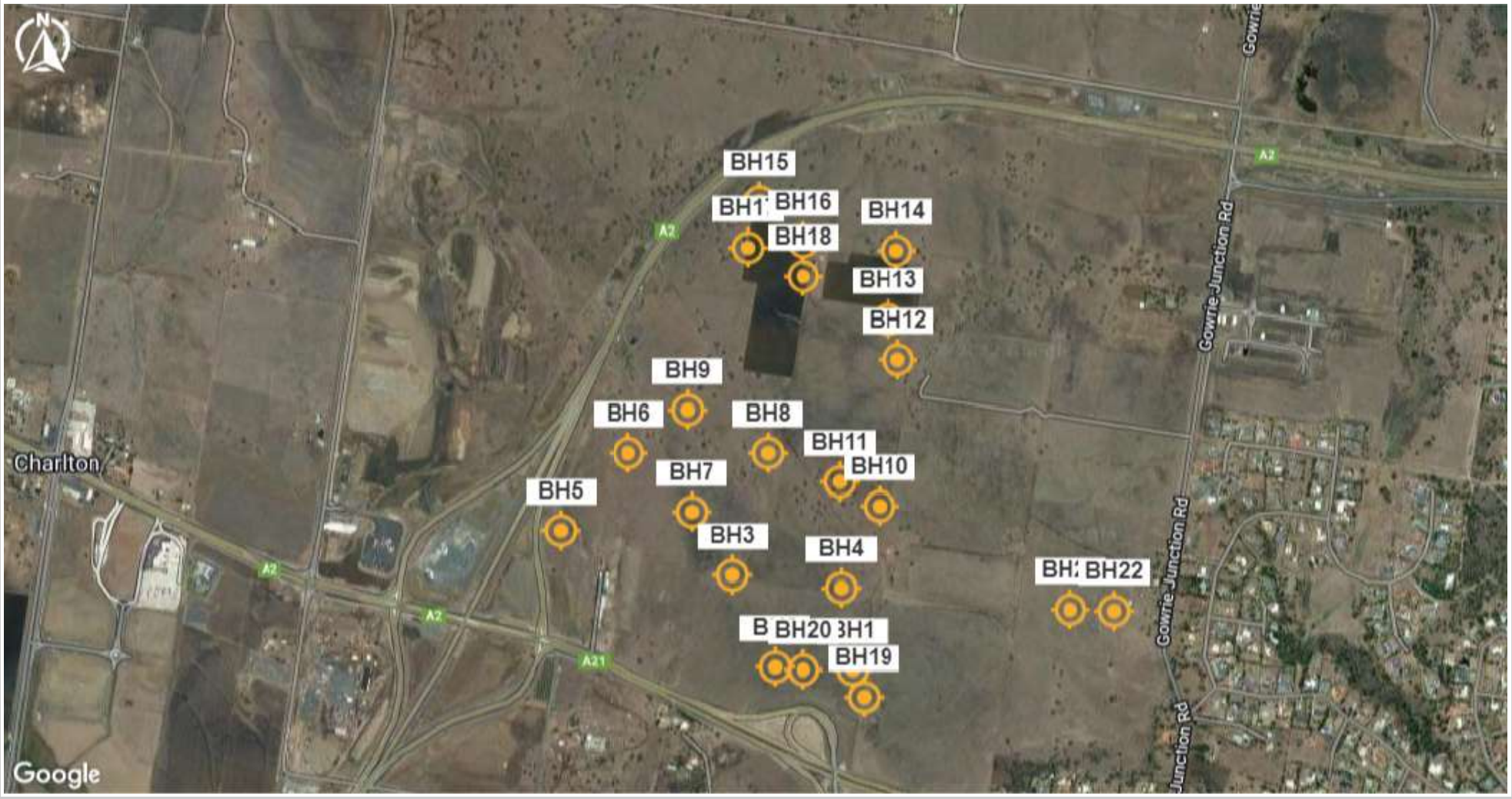
CONSULTANTS: GHD, open architecture studio

LEAD CONSULTANT: OTIUM SPORT + LEISURE

GREENEDGE DESIGN
creative thinking | design edge
Landscape Architecture | Urban design | Master Planning | Environmental

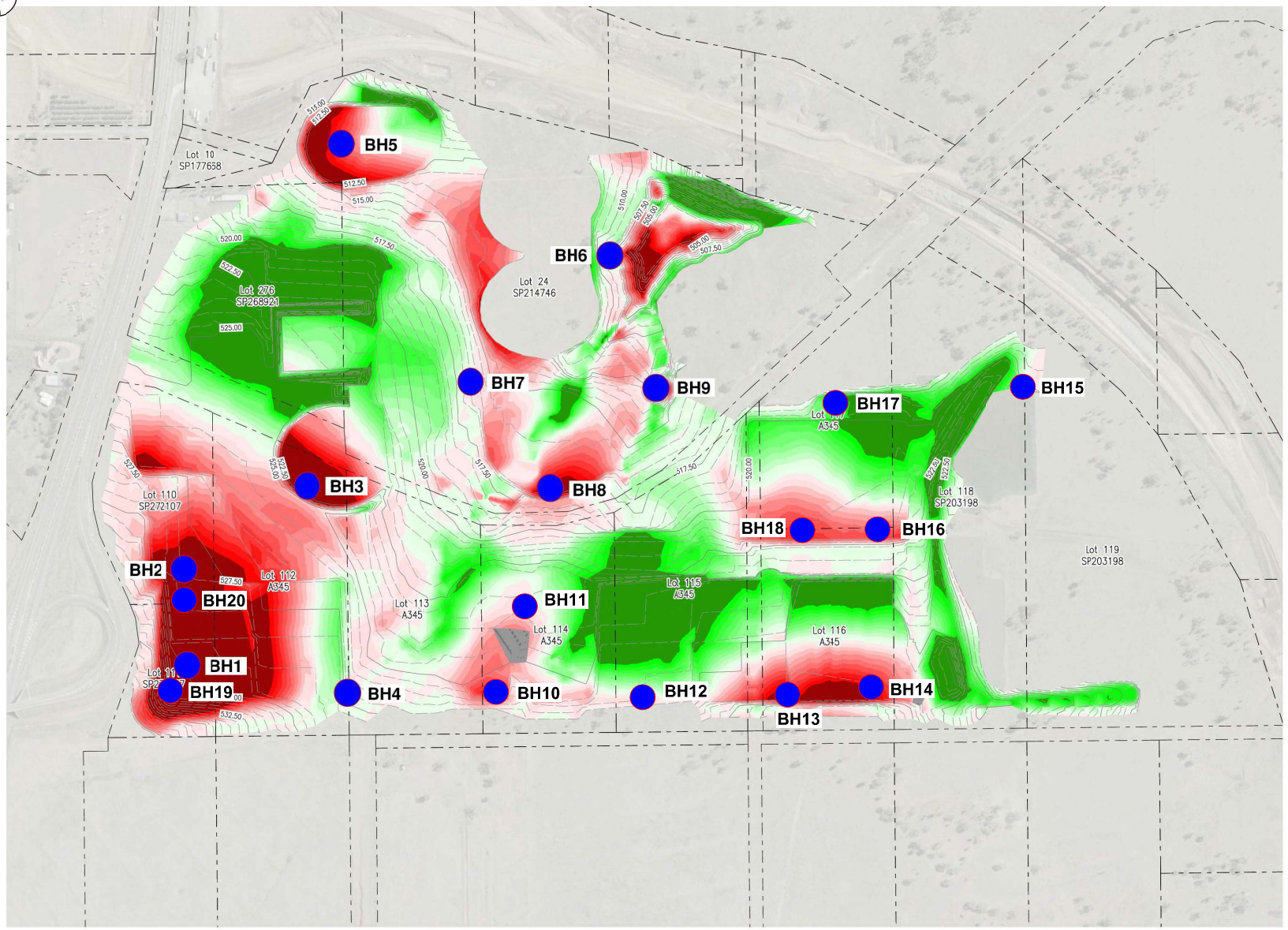
9.3 APPENDIX C

9.3.1 Borelogs Locations



RMA Soils
(07) 4639 4100
5 Bowen Street,
Toowoomba Qld 4350
enquiries@rmasoils.com.au

Map description	0239 Site Map		
Site location	Charlton QLD		
Client	RMA ENGINEERS		
Project name	TRC Sports Precinct Charlton		
Project No	21-S-0239	**Scale**	Not to Scale



CONCEPT EARTHWORKS EXTENT

Scale 1:3000 (A1)

LEGEND:

- Existing Property Boundary
- Proposed Property Boundary
- Bulk Earthworks Minor Contours
- Bulk Earthworks Major Contours

PLAN NOTES:

P.1. This is a sketch plan only and is conceptual only.
P.2. This sketch plan represents design intent and concepts only.
P.3. This plan shall not be used for tendering, financing, ordering of materials, construction or any other unintended purpose.
P.4. Information shown on these plans has been compiled from varying sources and may not be accurate and will need verifying. This includes existing infrastructure, property boundaries and natural surface data.
P.5. This plan shall not be relied upon for detailed design.
P.6. Concept design surface and Lidar existing surface provided by Toowoomba Regional Council.

CUT & FILL LEGEND

	Colour	Data Range [m]
FILL		> 2.00
		2.00 to 1.80
		1.80 to 1.60
		1.60 to 1.40
		1.40 to 1.20
		1.20 to 1.00
		1.00 to 0.80
		0.80 to 0.60
		0.60 to 0.40
		0.40 to 0.20
		0.20 to 0.00
CUT		0.00 to −0.20
		−0.20 to −0.40
		−0.40 to −0.60
		−0.60 to −0.80
		−0.80 to −1.00
		−1.00 to −1.20
		−1.20 to −1.40
		−1.40 to −1.60
		−1.60 to −1.80
		−1.80 to −2.00
		> −2.00

SCALE BARS

0 30 60 90 120m

1:3000(A1) 1:6000(A3)

ISSUE	DESCRIPTION	DATE	DWN	DES	CHK	APP
A	FOR COORDINATION	22/09/21	KW	-	-	-

ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE PROJECT NOTES ON DRAWING G0102

VERIFY ALL ON SITE DIMENSIONS AND LEVELS PRIOR TO CONSTRUCTION. NOTIFY RMA IMMEDIATELY OF ANY DISCREPANCIES

RMA Engineers
www.rmaeng.com.au

CLIENT
TOOWOOMBA REGIONAL COUNCIL
541 RUTHVEN STREET
TOOWOOMBA QLD 4350

PROJECT
TOOWOOMBA SPORTS PRECINCT

TOOWOOMBA, QLD

TITLE
CONCEPT EARTHWORKS EXTENT

R.P.E.Q.

THIS DOCUMENT IS UNCONTROLLED AND IS NOT TO BE USED FOR CONSTRUCTION UNTIL THIS NOTE IS REMOVED AND A DIGITAL SIGNATURE PROVIDED IN ITS PLACE

HEIGHT DATUM	GRID	SIZE
AHD	MGA-56	A1

COUNCIL RAL/MCU NO.

COUNCIL OW NO.

PROJECT NO.	DRAWING NO.	ISSUE
16567	C-SK001	A

Last saved: Konshens Wickmanakers

C:\16567\Acad\C-SK001.dwg

9.4 APPENDIX D

9.4.1 Borelogs BH1 – BH22

RMA Soils
Toowoomba
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No.: BH1

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388695.8	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6954790.4	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Atterberg Limits	ASS Sample
100mm SFA			0.0	Natural		CH	SILTY CLAY (CH) : Stiff, high plasticity, black, w < pl. (dry)		w < PL	St					
			0.5	Rock		BAS	BASALT: Extremely weathered, fine to medium grained, light yellow brown, medium plasticity clay, fine sized gravel, dry. (recovered as: clayey gravelly sand)	XW	D	MD					
			1.0												
			2.0											LL - 36% LS - 8.0% Iss - 1.4	
			3.0												
			3.2	Rock		BAS	BASALT: Extremely weathered, fine grained, yellow brown, low plasticity clay, with coarse sized gravel, dry. (recovered as: clayey sand)	XW	D	MD					

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

RMA Soils
Toowoomba
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No.: BH1

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388695.8	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6954790.4	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Atterberg Limits	ASS Sample
			4.0											LS - 8.6% Iss - 1.5	
			5.0				BH1 Terminated at 5m								

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
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- HW : Highly weathered
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RMA Soils
Toowoomba
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No.: BH2

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388462.4	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6954796.5	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	5kg Disturbed	ASS Sample
100mm SFA			0.5	Natural		CH	SILTY SANDY CLAY (CH) : Stiff, high plasticity, black mottled brown, fine grained sand, w < pl. (dry)		w < PL	St					
			1.0	Natural		CH	SILTY SANDY CLAY (CH) : Stiff, high plasticity, light brown mottled grey, fine grained sand, trace medium sized gravel, w < pl. (dry)		w < PL	St					
			1.5	Rock		BAS	BASALT: Stiff, high plasticity, light grey mottled red, medium to coarse sized gravel, fine grained sand, w < pl. (dry) (recovered as: sandy gravelly clay)	XW	w < PL	St				LL - 103% LS - 24.6% lss - 8.5	
			2.0												
			2.4	Rock		BAS	BASALT: Stiff, medium plasticity, yellow brown, medium sized gravel, fine grained sand, w < pl. (dry) (recovered as: sandy gravelly clay)	XW	w < PL	St					
			3.0												

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
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- SW : Slightly weathered
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- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

RMA Soils
Toowoomba
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No.: BH2

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388462.4	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6954796.5	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	5kg Disturbed	ASS Sample
			4.0												
			5.0 5				**BH2 Terminated at 5m**								

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
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RMA Soils
Toowoomba
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No.: BH3

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388330.5	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955067.8	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 4.5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Sample / Result	ASS Sample
100mm SFA			0.9	Natural		CH	SILTY CLAY (CH) : Stiff, high plasticity, black, w ≈ pl. (moist)		w ≈ PL	St					
			1.0	Rock		BAS	BASALT: Stiff, medium plasticity, light brown, fine sized gravel, medium grained sand, w < pl. (dry) (recovered as: silty sandy gravelly clay)	XW	w < PL	St					
			1.8	Rock		BAS	BASALT: Extremely weathered, medium grained, yellow brown, low plasticity clay, medium sized gravel, dry. (recovered as: clayey gravelly sand)	XW	D	MD					
			2.0												
			3.0												

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

RMA Soils
Toowoomba
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No.: BH3

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388330.5	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955067.8	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 4.5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Sample / Result	ASS Sample
			4.0												
			4.5				BH3 Met refusal at 4.5m								
			5.0												

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No.: BH4

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388662.6	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955062.1	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 2.6m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Sample / Result	ASS Sample
100mm SFA			0.9	Natural		CH	SILTY CLAY (CH) : Stiff, high plasticity, black, trace medium sized gravel, w < pl. (moist)		w < PL	St					
			1.0	Rock		BAS	BASALT: Stiff, medium plasticity, brown, medium sized gravel, fine grained sand, w > pl. (dry) (recovered as: sandy gravelly clay)	XW	w > PL	St					
			2.2	Rock		BAS	BASALT: Extremely weathered, fine grained, purple brown, medium plasticity clay, fine sized gravel, dry. (recovered as: clayey gravelly sand)	XW	D	D					
			2.6				**BH4 Met refusal at 2.6m**								
			3.0												

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No.: BH5

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 387813.9	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955192.1	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 1.8m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Atterberg Limits	ASS Sample
100mm SFA			0.2	Natural		CH	SILTY CLAY (CH) : Firm, high plasticity, black, w < pl. (dry)		w < PL	F					
			0.9	Rock		BAS	BASALT: Extremely weathered, fine grained, light yellow brown, low plasticity clay, fine sized gravel, dry. (recovered as: clayey gravelly sand)	XW	D	MD					
			1.0	Rock		BAS	BASALT: Highly weathered, low strength, fine grained, light grey yellow, indistinct dry.	HW		LS				LL - 34% LS - 8.0% Iss - 1.4	
			1.8												
			2.0				**BH5 Met refusal at 1.8m**								

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No.: BH6

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388013.6	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955422.8	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 0.6m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Sample / Result	ASS Sample
100mm SFA			0.6	Rock		BAS	BASALT: Moderately weathered, medium strength, coarse grained, grey, distinct dry. (basalt cobbles & boulders)	MW		MS					
			1.0				**BH6 Met refusal at 0.6m**								

Water	Weathering	Altering	Consistency	Density	Rock Strength	Tests&Results
Water inflow	XW : Extremely weathered	XA : Extremely alterated	VS : Very soft	VL : Very loose	VLS : Very low	U50 : Undisturbed 50mm diam tube
Water outflow	DW : Distinctly weathered	DA : Distinctly alterated	S : Soft	L : Loose	LS : Low	D : Disturbed sample.
	HW : Highly weathered	HA : Highly alterated	F : Firm	MD : Medium dense	MS : Medium	SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
	MW : Moderately weathered	MA : Moderately alterated	St : Stiff	D : Dense	HS : High	PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
	SW : Slightly weathered	SA : Slightly alterated	VSt : Very stiff	VD : Very dense	VH : Very high	S : Vane shear value kPa
	FR : Fresh		H : Hard		XH : Extremely high	DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes
			FR : Friable			
			Moisture			
			D : Dry			
			M : Moist			
			W : Wet			

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Engineering Log - Borehole

Borehole No.: BH7

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388207.8	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955251.7	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 2.2m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Sample / Result	ASS Sample
100mm SFA			0.4	Natural		CH	SILTY CLAY (CH) : Stiff, high plasticity, black mottled brown, trace fine sized gravel, with fine grained sand, w < pl. (dry)		w < PL	St					
			1.0	Rock		BAS	BASALT: Extremely weathered, fine grained, grey brown, low plasticity clay, medium sized gravel, dry. (recovered as: clayey gravelly sand)	XW	D	MD					
			1.5	Rock		BAS	BASALT: Highly weathered, low strength, fine grained, grey, distinct dry.	HW		LS					
			2.0												
			2.2				**BH7 Met refusal at 2.2m**								
			3.0												

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No.: BH8

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388433.1	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955426.1	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 2.5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Atterberg Limits	ASS Sample
100mm SFA			0.0	Natural		CH	SILTY CLAY (CH) : Stiff, high plasticity, black, w < pl. (dry)		w < PL	St					
			0.4	Rock		BAS	BASALT: Extremely weathered, fine grained, light yellow, medium plasticity clay, medium sized gravel, dry. (recovered as: clayey gravelly sand)	XW	D	MD				LL - 36% LS - 9.1% Iss - 1.6	
			1.0												
			2.0												
			2.5				**BH8 Met refusal at 2.5m**								
			3.0												

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No.: BH9

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388190.6	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955549.9	Logged By	: Daniel Keogh	Project	: TRC Sports Precinct Charlton
RL	: N/A	Date	: 24/09/2021	Location	: Charlton QLD
Total Depth	: 5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Atterberg Limits	ASS Sample
100mm SFA			0.6	Natural		CH	GRAVELLY CLAY (CH) : Stiff, high plasticity, black mottled grey, medium sized gravel, trace fine grained sand, w < pl. (dry)		w < PL	St					
			1.0	Natural		CH	SANDY GRAVELLY CLAY (CH) : Stiff, high plasticity, brown, medium sized gravel, fine grained sand, w < pl. (dry)		w < PL	St					
			2.0											LL - 63% LS - 18.6% Iss - 4.7	
			3.0												
			3.2	Natural		CH	SANDY GRAVELLY CLAY (CH) : Stiff, high plasticity, grey mottled brown, medium sized gravel, fine grained sand, w < pl. (dry)		w < PL	St					

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Toowoomba
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Engineering Log - Borehole

Borehole No.: BH9

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388190.6	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955549.9	**Logged By**	: Daniel Keogh	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Date**	: 24/09/2021	**Location**	: Charlton QLD
Total Depth	: 5m				

Drilling Information				Material Description							Test Samples				
Drill Method	Water	RL	Hole Depth(m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency-Density-Strength	DC Test Results	Test Depth	Tests	Atterberg Limits	ASS Sample
			4.0												
			4.1	Rock		BAS	BASALT: Stiff, medium plasticity, yellow mottled brown, medium sized gravel, fine grained sand, w < pl. (dry) (recovered as: sandy gravelly clay)	XW	w < PL	St					
			5.0 5				**BH9 Terminated at 5m**								

Water
- Water inflow
- Water outflow

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa
- DC : Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No: BH10

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388771.2	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955273.6	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 5.5m	**Date**	: 14/03/2022		

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples
100mm SFA	0.5	Natural		CH	Silty to sandy CLAY (CH) : Stiff, high plasticity, brown red, fine to medium grained sand, w ≈ PL. (Dry to Moist)	w ≈ PL	St		
	0.8	Rock		BAS	BASALT : Extremely weathered, Stiff, medium plasticity, red with grey, fine to medium grained sand, trace medium sized gravel, Moist to Dry. (Silty Sandy CLAY)	M-D	St	XW	LL - 48% LS - 8.2% Iss - 1.4 EC - 4
	1								
	1.5								
	2								LL - 48% LS - 9.1% Iss - 1.6 EC - 4
	2.5								
	3								
	3.3	Rock		BAS	BASALT : Extremely weathered, Firm to stiff, medium plasticity, grey with red, fine to medium grained sand, with fine to medium sized gravel, Dry. (Silty Sandy CLAY)	D	F-St	XW	
	3.5								
	3.9	Rock		BAS	BASALT : Extremely weathered, Firm to stiff, medium plasticity, red with grey, fine to medium grained sand, with fine to medium sized gravel, Dry. (Silty Sandy CLAY)	D	F-St	XW	
	4								
	4.5								
	5								

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Engineering Log - Borehole

Borehole No: BH10

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388771.2	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955273.6	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 5.5m	Date	: 14/03/2022		

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples
100mm SFA		Rock		BAS	BASALT : Extremely weathered, Firm to stiff, medium plasticity, red with grey, fine to medium grained sand, with fine to medium sized gravel, Dry. (Silty Sandy CLAY)	D	F-St	XW	
	5.5				**BH10 Terminated at 5.5m**				
	6								
	6.5								
	7								
	7.5								
	8								
	8.5								
	9								
	9.5								
	10								

RMA Soils
5 Bowen Street, Toowoomba QLD 4350
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No: BH11

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388651.6	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955346.0	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 4m	Date	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0	100mm SFA	Natural		CH	Silty CLAY (CH) : Firm to stiff, high plasticity, black, trace fine to medium grained sand, w ≈ PL. (Dry to Moist)	w ≈ PL	F-St			
0.5		Rock		BAS	BASALT : Extremely weathered, Stiff, medium plasticity, brown yellow, trace fine sized gravel, w < PL. (Silty Sandy CLAY)	w < PL	St	XW	LL - 43% LS - 11.4% Iss - 2.1 EC - 4	
1.8		Rock		BAS	BASALT : Extremely weathered, Stiff, low to medium plasticity, grey brown, fine to medium grained sand, with fine to medium sized gravel, Dry. (Silty Sandy CLAY)	D	St	XW		
4										

BH11 Terminated at 4m

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Engineering Log - Borehole

Borehole No: BH12

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388823.5	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955702.7	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 8m	Date	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.5		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
0.7		Rock		BAS	BASALT : Extremely weathered, Stiff, medium plasticity, brown mottled orange, fine to medium grained sand, trace fine sized gravel, Dry. (Silty Sandy CLAY)	D	St	XW		
1										
1.4		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium sized, light brown yellow, fine to medium grained sand, tracemedium plasticity clay, Dry. (Sandy GRAVEL)	D	MD-D	XW		
1.5										
2	100mm SFA									
2.5										
3										
3.5									LL - 44% LS - 9.9% Iss - 1.8 EC - 4	
4										

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Engineering Log - Borehole

Borehole No: BH12

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388823.5	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955702.7	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 8m	Date	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
4.5	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium sized, light brown yellow, fine to medium grained sand, tracemedium plasticity clay, Dry. (Sandy GRAVEL)	D	MD-D	XW		
5										
5.5										
6										
6.5										
7										
7.5										
8										

BH12 refusal at 8m

RMA Soils
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Engineering Log - Borehole

Borehole No: BH13

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388789.8	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955822.5	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 6.8m	**Date**	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.5		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
1		Rock		BAS	BASALT : Extremely weathered, Stiff, high plasticity, brown and red, fine to medium grained sand, with fine sized gravel, Dry. (Silty Sandy CLAY)	D	St	XW		
1.2		Rock		BAS	BASALT : Extremely weathered, Stiff, high plasticity, light brown yellow, fine to medium grained sand, with fine sized gravel, w < PL. (Silty Sandy CLAY)	w < PL	St	XW	LL - 60% LS - 14.2% Iss - 2.9 EC - 4	
1.5	100mm SFA									
2										
2.5										
3										
3.5										
3.7		Rock		BAS	BASALT : Extremely weathered, Medium dense, fine to medium grained, brown light brown, with fine to medium sized gravel, tracelow plasticity clay, Dry. (Silty SAND)	D	MD	XW		
4										

RMA Soils
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Engineering Log - Borehole

Borehole No: BH13

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388789.8	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955822.5	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 6.8m	Date	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
4.5 5 5.5 6 6.5	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense, fine to medium grained, brown light brown, with fine to medium sized gravel, tracelow plasticity clay, Dry. (Silty SAND)	D	MD	XW	LL - 47% LS - 12.2% Iss - 2.3 EC - 4	
7 7.5 8					**BH13 refusal at 6.8m**					

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Engineering Log - Borehole

Borehole No: BH14

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388814.3	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6956023.8	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 4m	**Date**	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.4	100mm SFA	Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, trace fine grained sand, w > PL. (Moist)	w > PL	St			
1.4		Rock		BAS	BASALT : Extremely weathered, Stiff, medium plasticity, light brown yellow, fine to medium grained sand, Dry. (Silty Sandy CLAY)	D	St	XW	LL - 38% LS - 8.2% Iss - 1.4 EC - 4	
4		Rock		BAS	BASALT : Extremely weathered, Medium dense, fine to medium grained, light brown yellow, fine to medium sized gravel, tracelow plasticity clay, Dry. (Silty Gravelly SAND)	D	MD	XW		

BH14 refusal at 4m

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Engineering Log - Borehole

Borehole No: BH15

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388404.6	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6956164.9	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 3.8m	**Date**	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.4	100mm SFA	Natural		CH	Silty to sandy CLAY (CH) : Stiff, high plasticity, brown black, fine to medium grained sand, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
1.6		Rock		BAS	BASALT : Extremely weathered, Stiff, medium plasticity, light brown yellow, fine to medium grained sand, with fine to medium sized gravel, Dry. (Silty Sandy CLAY)	D	St	XW		
		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, medium to coarse sized, brown with grey, medium to coarse grained sand, tracemedium plasticity clay, Dry. (Silty Sandy GRAVEL)	D	MD-D	XW	LL - 38% LS - 9.9% Iss - 1.8 EC - 6	
					BH15 refusal at 3.8m					

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Engineering Log - Borehole

Borehole No: BH16

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388537.3	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6956046.1	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 4.2m	**Date**	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.4	100mm SFA	Natural		CH	Silty to sandy CLAY (CH) : Stiff, high plasticity, black, fine grained sand, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
0.9		Rock		BAS	BASALT : Extremely weathered, Stiff, medium plasticity, light brown yellow, fine grained sand, Dry. (Silty Sandy CLAY)	D	St	XW	LL - 33% LS - 4.9% Iss - 1 EC - 3	
4		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, yellow light brown, fine sized gravel, tracelow plasticity clay, Dry. (Silty Gravelly SAND)	D	MD-D	XW		

BH16 refusal at 4.2m

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Engineering Log - Borehole

Borehole No: BH16

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388537.3	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6956046.1	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 4.2m	Date	: 14/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, yellow light brown, fine sized gravel, tracelow plasticity clay, Dry. (Silty Gravelly SAND)	D	MD-D	XW		
					BH16 refusal at 4.2m					
4.5										
5										
5.5										
6										
6.5										
7										
7.5										
8										

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Engineering Log - Borehole

Borehole No: BH17

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388371.5	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6956027.6	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 1.8m	Date	: 14/03/2022		

Drilling Method	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples
	0.5	Natural		CH	Silty to sandy CLAY (CH) : Stiff, high plasticity, black, fine grained sand, w ≈ PL. (Dry to Moist)	w ≈ PL	St		LL - 72% LS - 18.1% Iss - 4.4 EC - 7
100mm SFA	1.6	Rock		BAS	BASALT : Extremely weathered, Medium dense, fine to medium grained, yellow light brown, low to medium plasticity clay, medium to coarse sized gravel, Dry. (Clayey Gravelly SAND)	D	MD	XW	
		Rock		BAS	BASALT : Extremely weathered, Dense, fine to medium grained, yellow light brown, medium sized gravel, tracelow plasticity clay, Dry. (Silty Gravelly SAND)	D	D	XW	
					BH17 refusal at 1.8m				

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Engineering Log - Borehole

Borehole No: BH18

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388534.4	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6955945.9	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 4.4m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.5		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
0.7		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine grained, light brown yellow, low to medium plasticity clay, with fine to medium sized gravel, Dry. (Clayey Silty SAND)	D	MD-D	XW		
1	100mm SFA									
1.5										
2										
2.5										
3										
3.5										
4										

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Engineering Log - Borehole

Borehole No: BH18

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388534.4	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6955945.9	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 4.4m	**Date**	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine grained, light brown yellow, low to medium plasticity clay, with fine to medium sized gravel, Dry. (Clayey Silty SAND)	D	MD-D	XW		
4.5					**BH18 refusal at 4.4m**					
5										
5.5										
6										
6.5										
7										
7.5										
8										

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Engineering Log - Borehole

Borehole No: BH19

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388729.9	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954710.8	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 8.1m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0	100mm SFA	Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
0.9		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, brown black, trace fine to medium sized gravel, trace fine to medium grained sand, Moist to Dry to w ≈ PL. (Dry to Moist)		St			
1.8		Rock		BAS	BASALT : Extremely weathered, Stiff, high plasticity, light brown orange, fine to medium grained sand, trace fine sized gravel, Dry. (Silty Sandy CLAY)	D	St	XW		
2.7		Rock		BAS	BASALT : Extremely weathered, Medium dense, fine to medium grained, light brown, trace fine sized gravel, tracelow to medium plasticity clay, Dry. (Silty SAND)	D	MD	XW		
3.8		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, grey black, fine to medium sized gravel, tracemedium plasticity clay, Dry. (Silty Gravelly SAND)	D	MD-D	XW		

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Engineering Log - Borehole

Borehole No: BH19

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388729.9	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954710.8	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 8.1m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, grey black, fine to medium sized gravel, tracemedium plasticity clay, Dry. (Silty Gravelly SAND)	D	MD-D	XW		
4.5										
5										
5.5										
6	100mm SFA									
6.5										
7										
7.5										
8										

BH19 refusal at 8.1m

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Engineering Log - Borehole

Borehole No: BH19

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 388729.9	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6954710.8	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 8.1m	**Date**	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, grey black, fine to medium sized gravel, tracemedium plasticity clay (Basalt Gravelly SAND)	D	MD-D	XW		
8.5					**BH19 refusal at 8.1m**					
9										
9.5										
10										
10.5										
11										
11.5										
12										

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Engineering Log - Borehole

Borehole No: BH20

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388547.8	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954791.2	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 10m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
0.5									LL - 89% LS - 23.0% Iss - 7.5 EC - 7	
0.8		Rock		BAS	BASALT : Extremely weathered, Medium dense, fine to medium grained, brown, medium plasticity clay, fine sized gravel, Dry. (Clayey Gravelly SAND)	D	MD	XW		
1										
1.5										
1.9										
2	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Dense, fine to medium grained, light brown, fine to medium sized gravel, tracelow to medium plasticity clay, Dry. (Silty Gravelly SAND)	D	D	XW	LL - 65% LS - 18.2% Iss - 4.4 EC - 3	
2.5										
3										
3.5										
4										

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Engineering Log - Borehole

Borehole No: BH20

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388547.8	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954791.2	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 10m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Dense, fine to medium grained, light brown, fine to medium sized gravel, tracelow to medium plasticity clay, Dry. (Silty Gravelly SAND)	D	D	XW	LL - 49% LS - 12.7% Iss - 2.4 EC - 2	
7.8		Rock		BAS	BASALT : Extremely weathered, Dense, fine to medium grained, brown red, low to medium plasticity clay, fine to medium sized gravel, Dry. (Clayey Gravelly SAND)	D	D	XW		

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Engineering Log - Borehole

Borehole No: BH20

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 388547.8	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954791.2	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 10m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
8.5	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Dense, fine to medium grained, brown red, low to medium plasticity clay, fine to medium sized gravel, Dry. (Clayey Gravelly SAND)	D	D	XW		
9										
9.5										
10					**BH20 Terminated at 10m**					
10.5										
11										
11.5										
12										

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Engineering Log - Borehole

Borehole No: BH21

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 389347.8	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954974.1	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 5m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.5		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
0.6		Rock		BAS	BASALT : Extremely weathered, Medium dense, fine grained, light brown yellow, trace fine sized gravel, with low to medium plasticity clay, Dry. (Silty SAND)	D	MD	XW		
1										
1.1		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, brown, fine to medium sized gravel, tracelow plasticity clay, Dry. (Silty Gravelly SAND)	D	MD-D	XW		
1.5										
2	100mm SFA									
2.5										
3										
3.5										
4										

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Engineering Log - Borehole

Borehole No: BH21

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 389347.8	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954974.1	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 5m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
4.5	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, brown, fine to medium sized gravel, tracelow plasticity clay, Dry. (Silty Gravelly SAND)	D	MD-D	XW		
5					**BH21 Terminated at 5m**					
5.5										
6										
6.5										
7										
7.5										
8										

RMA Soils
5 Bowen Street, Toowoomba QLD 4350
Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No: BH22

UTM	: 56J	**Driller Rig**	: Fuso Drill Rig	**Job Number**	: 21-S-0239
Easting	: 389477.5	**Driller Supplier**	: RMA Soils	**Client**	: RMA ENGINEERS
Northing	: 6954972.1	**Logged By**	: Craig Adamski	**Project**	: TRC Sports Precinct Charlton
RL	: N/A	**Reviewed By**	:	**Location**	: Charlton QLD
Total Depth	: 5m	**Date**	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
0.5	100mm SFA	Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, black, w ≈ PL. (Dry to Moist)	w ≈ PL	St			
1		Natural		CH	Silty CLAY (CH) : Stiff, high plasticity, light brown, trace fine grained sand, Dry to w < PL. (Dry)		St			
2.8		Rock		BAS	BASALT : Extremely weathered, Stiff, medium to high plasticity, brown red, fine grained sand, Dry. (Sandy CLAY)	D	St	XW		
4		Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, brown with yellow, low to medium plasticity clay, trace fine sized gravel, Dry. (Clayey Silty SAND)	D	MD-D	XW		

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Phone: 07 3846 5885

Engineering Log - Borehole

Borehole No: BH22

UTM	: 56J	Driller Rig	: Fuso Drill Rig	Job Number	: 21-S-0239
Easting	: 389477.5	Driller Supplier	: RMA Soils	Client	: RMA ENGINEERS
Northing	: 6954972.1	Logged By	: Craig Adamski	Project	: TRC Sports Precinct Charlton
RL	: N/A	Reviewed By	:	Location	: Charlton QLD
Total Depth	: 5m	Date	: 15/03/2022		

Depth (m)	Drilling Method	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Weathering	Samples	DCP
4.5	100mm SFA	Rock		BAS	BASALT : Extremely weathered, Medium dense to dense, fine to medium grained, brown with yellow, low to medium plasticity clay, trace fine sized gravel, Dry. (Clayey Silty SAND)	D	MD-D	XW		
5					**BH22 Terminated at 5m**					
5.5										
6										
6.5										
7										
7.5										
8										

9.5 APPENDIX E

9.5.1 Atterberg Limits Reports

Material Test Report

Report Number: **21-S-0239-1**
Issue Number: 1
Date Issued: 25/10/2021
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2297
Sample Number: 21-2297A
Date Sampled: 24/09/2021
Dates Tested: 27/09/2021 - 19/10/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **BH1, Depth: 2000mm**

Atterberg Limit (AS1289 3.9.2 & 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	36		
Plastic Limit (%)			
Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	8.0		
Cracking Crumbling Curling	Cracking		

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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Danny Coleborn
Director
NATA Accredited Laboratory Number: 19407

Material Test Report

Report Number: **21-S-0239-1**
Issue Number: 1
Date Issued: 25/10/2021
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2297
Sample Number: 21-2297B
Date Sampled: 24/09/2021
Dates Tested: 27/09/2021 - 19/10/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **BH1, Depth: 3500mm**

Atterberg Limit (AS1289 3.9.2 & 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	36		
Plastic Limit (%)			
Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	8.5		
Cracking Crumbling Curling	None		

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Director
NATA Accredited Laboratory Number: 19407

Material Test Report

Report Number: **21-S-0239-1**
Issue Number: 1
Date Issued: 25/10/2021
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2297
Sample Number: 21-2297C
Date Sampled: 24/09/2021
Dates Tested: 27/09/2021 - 19/10/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **BH2, Depth: 2000mm**

Atterberg Limit (AS1289 3.9.2 & 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	103		
Plastic Limit (%)			
Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	24.5		
Cracking Crumbling Curling	Cracking & Crumbling		

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Director
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Material Test Report

Report Number: **21-S-0239-1**
Issue Number: 1
Date Issued: 25/10/2021
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2297
Sample Number: 21-2297D
Date Sampled: 24/09/2021
Dates Tested: 27/09/2021 - 19/10/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **BH5, Depth: 1000mm**

Atterberg Limit (AS1289 3.9.2 & 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	34		
Plastic Limit (%)			
Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	8.0		
Cracking Crumbling Curling	Cracking		

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Director
NATA Accredited Laboratory Number: 19407

Material Test Report

Report Number: **21-S-0239-1**
Issue Number: 1
Date Issued: 25/10/2021
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2297
Sample Number: 21-2297E
Date Sampled: 24/09/2021
Dates Tested: 27/09/2021 - 19/10/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **BH8, Depth: 1500mm**

Atterberg Limit (AS1289 3.9.2 & 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	36		
Plastic Limit (%)			
Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	9.0		
Cracking Crumbling Curling	Cracking		

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Material Test Report

Report Number: **21-S-0239-1**
Issue Number: 1
Date Issued: 25/10/2021
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2297
Sample Number: 21-2297F
Date Sampled: 24/09/2021
Dates Tested: 27/09/2021 - 19/10/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **BH9, Depth: 2000mm**

Atterberg Limit (AS1289 3.9.2 & 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	63		
Plastic Limit (%)			
Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	18.5		
Cracking Crumbling Curling	Cracking		

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Approved Signatory: Danny Coleborn
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NATA Accredited Laboratory Number: 19407

Material Test Report

Report Number: 21-S-0239-2
Issue Number: 1
Date Issued: 12/04/2022
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2860
Date Sampled: 14/03/2022
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and preparation of soils
Location: Charlton Sports Complex - Geotechnical Investigation

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Approved Signatory: Danny Coleborn
Director
NATA Accredited Laboratory Number: 19407

Sample Details							
Sample Number	22-2860A	22-2860B	22-2860C	22-2860D	22-2860E		
Date Sampled	14/03/2022	14/03/2022	14/03/2022	14/03/2022	14/03/2022		
Sample Location	BH10	BH10	BH11	BH12	BH13		
Sample Depth	0.80-1.20m	2.00-3.00m	0.70-1.10m	3.50-4.00m	1.50-2.00m		
Material	Rock, Basalt Extremely Weathered Red with Grey	Rock, Basalt Extremely Weathered Red with Grey	Rock, Basalt Extremely Weathered Brown Yellow	Rock, Basalt Extremely Weathered Light Brown Yellow	Rock, Basalt Extremely Weathered Light Brown Yellow		
Atterberg Limits Atterberg Limit (AS1289 3.9.2 & 3.4.1)						Min	Max
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried		
Preparation Method	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve		
Liquid Limit (%)	48	48	43	44	60		
Plastic Limit (%)	**	**	**	**	**		
Plasticity Index (%)	**	**	**	**	**		
Linear Shrinkage (AS 1289 3.4.1)						Min	Max
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried		
Preparation Method	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2		
Linear Shrinkage (%)	8.0	9.0	11.5	10.0	14.0		
Cracking Crumbling Curling	Cracking	Cracking	**	None	Cracking		
Emerson Class Number of a Soil (AS 1289 3.8.1)						Min	Max
Soil Description	Silty Sandy Clay, Red	Silty Sandy Clay, Red	Sandy Gravelly Clay, Brown	Silty Gravel, Light Brown	Silty Sandy Clay, Grey Brown		
Nature of Water	Distilled	Distilled	Distilled	Distilled	Distilled		
Temperature of Water (°C)	24.0	24.0	24.0	24.0	24.0		
* Mineral Present	Carbonate	Carbonate	Carbonate	Carbonate	Carbonate		
Emerson Class	4 *	4 *	4 *	4 *	4 *		

Material Test Report

Report Number: 21-S-0239-2
Issue Number: 1
Date Issued: 12/04/2022
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2860
Date Sampled: 14/03/2022
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and preparation of soils
Location: Charlton Sports Complex - Geotechnical Investigation

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Approved Signatory: Danny Coleborn
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NATA Accredited Laboratory Number: 19407

Sample Details							
Sample Number	22-2860F	22-2860G	22-2860H	22-2860I	22-2860J		
Date Sampled	14/03/2022	14/03/2022	14/03/2022	14/03/2022	14/03/2022		
Sample Location	BH13	BH14	BH15	BH16	BH17		
Sample Depth	4.50-5.00m	0.40-0.80m	2.50-3.00m	0.40-0.80m	0.00-0.40m		
Material	Rock, Basalt Extremely Weathered Brown Light Brown	Rock, Basalt Extremely Weathered Light Brown Yellow	Rock, Basalt Extremely Weathered Light Brown with Grey	Rock, Basalt Extremely Weathered Light Brown Yellow	Silty Sandy CLAY, Black		
Atterberg Limits Atterberg Limit (AS1289 3.9.2 & 3.4.1)						Min	Max
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried		
Preparation Method	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve		
Liquid Limit (%)	47	38	38	33	72		
Plastic Limit (%)	**	**	**	**	**		
Plasticity Index (%)	**	**	**	**	**		
Linear Shrinkage (AS 1289 3.4.1)						Min	Max
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried		
Preparation Method	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2		
Linear Shrinkage (%)	12.0	8.0	10.0	5.0	18.0		
Cracking Crumbling Curling	Cracking	Cracking	Cracking	None	Cracking		
Emerson Class Number of a Soil (AS 1289 3.8.1)						Min	Max
Soil Description	Silty Sandy Clay, Brown	Silty Sandy Clay, Light Brown	Silty Sandy Gravel, Brown	Silty Sandy Gravel, Yellow Brown	Sandy Clay, Black		
Nature of Water	Distilled	Distilled	Distilled	Distilled	Distilled		
Temperature of Water (^{o}C)	24.0	24.0	24.0	24.0	24.0		
Emerson Class	4 *	4 *	6	3	7		

Material Test Report

Report Number: 21-S-0239-2
Issue Number: 1
Date Issued: 12/04/2022
Client: RMA Engineers
5 Bowen Street, Toowoomba QLD 4350
Contact: Stu Doyle
Project Number: 21-S-0239
Project Name: TRC Sports precinct Charlton
Project Location: Charlton
Work Request: 2860
Date Sampled: 14/03/2022
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and preparation of soils
Location: Charlton Sports Complex - Geotechnical Investigation

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Approved Signatory: Danny Coleborn
Director
NATA Accredited Laboratory Number: 19407

Sample Details							
Sample Number	22-2860K	22-2860L	22-2860M	22-2860N			
Date Sampled	14/03/2022	14/03/2022	14/03/2022	14/03/2022			
Sample Location	BH20	BH20	BH20	BH21			
Sample Depth	0.30-0.60m	2.00-2.50m	5.00-5.50m	9.00-10.00m			
Material	Silty CLAY, Black	Rock, Basalt Extremely Weathered Light Brown Orange	Rock, Basalt Extremely Weathered Grey Black	Rock, Basalt Extremely WeatheRed Brown Red			
Atterberg Limits Atterberg Limit (AS1289 3.9.2 & 3.4.1)						Min	Max
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried			
Preparation Method	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve			
Liquid Limit (%)	89	65	49	72			
Plastic Limit (%)	**	**	**	**			
Plasticity Index (%)	**	**	**	**			
Linear Shrinkage (AS 1289 3.4.1)						Min	Max
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried			
Preparation Method	Dry Sieve	Dry Sieve	Dry Sieve	Dry Sieve			
Moisture Condition Determined By	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2	AS 1289.3.9.2			
Linear Shrinkage (%)	23.0	18.0	12.5	17.0			
Cracking Crumbling Curling	Cracking	Cracking	None	Cracking			
Emerson Class Number of a Soil (AS 1289 3.8.1)						Min	Max
Soil Description	Silty Clay, Black	Sandy Clay, Brown	Sandy Clay, Grey Brown	Sandy Clay, Red Brown			
Nature of Water	Distilled	Distilled	Distilled	Distilled			
Temperature of Water (°C)	24.0	24.0	24.0	24.0			
* Mineral Present	**	**	**	Carbonate			
Emerson Class	7	3	2	4 *			